CLAIMS

1. An Algorithm for projecting information data belonging to a multidimensional space into a space having less dimensions comprising the following steps:

Providing a database of N-dimensional data in the form of records having a certain number of variables.

Defining a metric function for calculating a distance between each record of the database.

Calculating a matrix of distances between each record of the database by means of the metric function defined at the previous step

Defining a n-1 dimensional space in which each record is defined by n-1 coordinates.

Calculating the n-1 coordinates of each record in the n-1 dimensional space by means of an evolutionary algorithm;

Defining as the best projection of the records onto the n-1 dimensional space the projection in which the distance matrix of the records in the n-1 dimensional space best fits or has minimum differences with the distance matrix of the records calculated in the n-dimensional space.

2. An algorithm according to claim 1 in which a database is provided in which the distances between the records are already contained.

3. An algorithm according to claim 1 or 2, characterised in that as an evolutionary algorithm a so called genetic algorithms is used.

4. An algorithm according to one or more of the preceding claims, characterised by the following steps:

encoding each individual record or variable represented by a point having coordinate X and Y;

defining a set of different X and Y coordinates for each point forming a first population of projections solution onto the less dimensional space, usually a two or three dimensional space.

Calculating the fitness score for each of the projections of this first population by using as the fitness function the matrix of distances of the single points in the originally N dimensional space;

Subjecting the population of projections to combination according to certain combination rules thus producing a first generation population of projections which comprises X and Y coordinates for the points which are a combination of the coordinates provided in two projections of the parent generation;

Calculating the fitness score of the projections of the first generation and forming again a new generation basing on the first generation.

5. An Algorithm according to one or more of the preceding claims, characterised in that the genetic algorithm is the so called GenD algorithm.

6. An algorithm according to one or more of the preceding claims, characterised in that a hidden point can be defined, which corresponds to a hidden record or a to a hidden variable and whose existence is only guessed, the said hidden point is added in the parent population by giving to it position coordinates X_{hi} and Y_{hi} in the projection.

7. An algorithm according to claim 6, characterised in that the calculation of the evolutionary algorithm is carried out in parallel with the hidden point and without the hidden point and the best fit projections obtained by the two parallel calculations is compared.

8. An algorithm according to one or more of the preceding claims characterised by the further steps of providing a database comprising a certain number of records each one characterised by a certain number of variables,

elaborating the database alternatively or in parallel according to two ways:

a first way by which the records are considerd as being points and the variables as being the coordinates of the points.

A second way by which the variables are considered as being points and the records are the coordinates.

9. An algorithm according to one or more of the preceding claims, comprising a further different algorithm treating the database as a pre or post processing phase.

10 An algorithm according to claim 9, characterised in that the database is processed in a preventive stage by means of a Self Organising Map algorithm, the clusters formed by this algorithm in the different units being subjected to a projection by means of the algorithm according to one or more of the proceeding claims.

11. A method for the cognitive analysis of multidimensional information data comprising the following steps:

providing a database with a certain number of records each one comprising a certain number of variables and which are relative to a N-dimensional space;

projecting the database considering the record as points and the variables as coordinates or the

variables as points and the records as coordinates onto a space having a reduced number of dimension relatively to the space N dimensional space;

the projection being carried out by means of an Algorithm for projecting information data belonging to a multidimensional space into a space having less dimensions comprising the following steps:

Calculating a matrix of distances between each point defined by a record or a variable of the database by means of a metric function;

Defining a n-1 dimensional space in which each point represented by a record or a variable is defined by n-1 coordinates.

Calculating the n-1 coordinates of each point in the n-1 dimensional space by means of an evolutionary algorithm;

Defining as the best projection of the points onto the n-1 dimensional space the projection in which the distance matrix of the points in the n-1 dimensional space best fits or has minimum differences with the distance matrix of the points calculated in the n-dimensional space.

12. A method according to claim 11 characterised in that a database is provided in which the distances between the records are already contained.

13. A method according to claims 11 or 12, characterised in that as an evolutionary algorithm a so called genetic algorithms is used.

14. A method according to one or more of the preceding claims 11 to 13, characterised by an algorithm executing the following steps:

encoding each individual record or variable represented by a point having coordinate X and Y;

defining a set of different X and Y coordinates for each point forming a first population of projections solution onto the less dimensional space, usually a two or three dimensional space.

Calculating the fitness score for each of the projections of this first population by using as the fitness function the matrix of distances of the single points in the originally N dimensional space;

Subjecting the population of projections to combination according to certain combination rules thus producing a first generation population of projections which comprises X and Y coordinates for the points which are a combination of the coordinates provided in two projections of the parent generation;

Calculating the fitness score of the projections of the first generation and forming again a new generation basing on the first generation.

15. A method according to one or more of the preceding claims 11 to 14, characterised in that the evolutionary algorithm is the so called GenD algorithm.

16. A method according to one or more of the preceding claims 11 to 15, characterised in that a hidden point represented by a hidden record or a hidden variable can be defined, which corresponds to a hidden point on the map and whose existence is only guessed, the said hidden point being added in the parent population by giving to its position coordinates X_{hi} and Y_{hi} in the projection.

17. A method according to claim 16, characterised in that the calculation of the evolutionary algorithm is carried out in parallel with the hidden point and without the hidden point and the best fit projections obtained by the two parallel calculations is compared.

18. A method according to one or more of the preceding claims characterised by the further steps of providing a database comprising a certain number of records each one characterised by a certain number of variables,

elaborating the database alternatively or in parallel according to two ways:

a first way by which the records are considered as being points and the variables as being the coordinates of the points.

A second way by which the variables are considered as being points and the records are the coordinates.

19. A method according to one or more of the preceding claims 11 to 18, comprising a further different algorithm treating the database as a pre or post processing phase.

20 A method according to claim 19, characterised in that the database is processed in a preventive stage by means of a Self Organising Map algorithm, the clusters formed by this algorithm in the different units being subjected to a projection by means of the algorithm according to one or more of the proceeding claims.

21. A method according to one or more of the preceding claims 11 to 20, characterised in that the clustering or distance of the points on the map on which the database has been projected is used as a measure of similarity of the records or of the variables related to the said point.

22. A method according to one or more of the preceding claims, characterised in that a database comprising a certain number of records each one being

related to a certain number of variables is provided, to the said database being further added the complementary variables to the variables originally provided and the said integrated database being subjected to projection onto a less dimensional space, particularly on a two or three dimensional space;

The distance in the map between each variable and its complementary variable being used as a measure for the relevance of said variable in the database.

23 A method according to one or more of the preceding claims, characterised in that it is a method for evaluating the relevance of certain variables in determining a certain pathological status of individuals and a method for defining prototypes of individuals relatively to the variables of the database and their probability of developing a certain disease.

24. A method according to one or more of the preceding claims characterised in that it is a method for analysing the probability of an individual of having or of developing the Alzheimer disease.

25. A method according to one or more of the preceding claims 11 to 27, characterised in that it is in the form of a program saved on a removable support.

26 An Algorithm according to one or more of the preceding claims 1 to 10, characterised in that it is in the form of a program saved on a removable support.

27. A method according to one or more of the preceding claims 11 to 22, characterised in that it is a method for generating two dimensional maps of geographic sites starting form a database comprising relative distances of the sites.

28. A method for generating two or three dimensional maps of geographic sites starting form a

database comprising relative distances of the sites, the method comprising the following steps of:

a) organizing the known or measured distance values of the geographical sites in a matrix form;

b) defining a two or a three dimensional space in which the position of each site is univoquely defined by two or three coordinates;

c) determining the two or three coordinates of the position in the two or three dimensional space of each geographical site by means of an evolutionary algorithm;

d) determining the distances of the geographical sites one form the other by means to the calculated two or three dimensional coordinates of position of the said geographical sites one from the other;

e) generating a matrix of distances with the distances values which has been determined according to step d);

f) defining as the best two or three dimensional coordinates of position of the totality of the geographical sites in the two or three dimensional space, the two or three dimensional coordinates of position of the said geographical sites for which the distance matrix determined therefrom best fits or has a minimum difference with the distance matrix of the known or measured distance values of the geographical sites.

29. A method according to claims 27 or 28 characterized in that the evolutionary algorithm is a so called genetic algorithm.

30. A method according to one or more of the preceding claims 27 to 29, characterized in that

a) for each geographical site a first and a second set of coordinates defining the position of each geographical site in the two or three dimensional space is calculated;

b) calculating the fitness score of the matrix of distances among the geographical sites determined by means of the first and second set of coordinates defining the position of each geographical site in the two or three dimensional space, by using as a fitness function the matrix of the known or measured distances of the geographical sites;

c) subjecting the first and second set of coordinates of position of each geographical site to combination for each geographical site according to predetermined combination rules, thus producing at least a new first and second set of coordinates of position for each geographical site;

d) calculating the fitness score of the said new first and second set of coordinates of position according to step b);

e) subjecting the said new first and second set of coordinates of position again to combination according to step c) and repeating the said steps c to e) until at least one new first or second set of coordinates of position reaches a maximum fitness score or is greater than a minimum predefined fitness score.

31. A method according to claim 30, characterized in that for each combination steps of at least one first and one second set of coordinates several new sets of coordinates are obtained by the combinations of the said at least first and second set of coordinates.

32. A method according to one or more of the preceding claims characterized in that at least one

hidden or hypothetic geographical site is added to the database of geographical sites of which neither the coordinates nor the distances are known and a first and a second set of coordinates for the said at least one geographical site being freely defined.

33. A method according to claim 32, characterised in that the calculation of the evolutionary algorithm is carried out in parallel for the database provided with the hidden or hypothetic geographical site and without the hidden or hypothetic geographical site and the best fit set of coordinates of position of the totality of the geographical sites obtained by the two parallel calculations are compared.

34. A method according to one or more of the preceding claims 27 to 33, characterised in that a further different pre or post processing phase is provided.

35. A method according to claim 34, characterised in that in a preventive phase the known distance data matrix is subjected to treatment by means of a Self Organising Map algorithm, the clusters formed by this algorithm in the different units being then subjected to the method steps according to one or m ore of the preceding claims 27 to 34.

36. A method according to one or more of the preceding claims 11 to 22, characterised in that it is a method for representing the structure of a molecule onto a three dimensional or a two dimensional steps by indicating only the relative distances of the atoms of the molecule.

37. A method for representing the structure of a molecule onto a three dimensional or a two dimensional steps by indicating only the relative distances of at

least part of the atoms of the molecule relatively one to the other, characterised in that it comprises the following steps:

a) organizing the known or measured distance values of the atoms in a matrix form;

b) defining a two or a three dimensional space in which the position of each atom is univoquely defined by two or three coordinates;

c) determining the two or three coordinates of the position in the two or three dimensional space of each atom by means of an evolutionary algorithm;

d) determining the distances of the atoms one form the other by means to the calculated two or three dimensional coordinates of position of the said atoms one from the other;

e) generating a matrix of distances with the distances values which has been determined according to step d);

f) defining as the best two or three dimensional coordinates of position of the totality of the atoms in the two or three dimensional space, the two or three dimensional coordinates of position of the said atoms for which the distance matrix determined therefrom best fits or has a minimum difference with the distance matrix of the known or measured distance values of the atoms.

38. A method according to claims 36 or 37 characterized in that the evolutionary algorithm is a so called genetic algorithm.

39. A method according to one or more of the preceding claims 36 to 38, characterized in that

a) for each atom a first and a second set of coordinates defining the position of atom in the two or three dimensional space is calculated;

b) calculating the fitness score of the matrix of distances among the atoms determined by means of the first and second set of coordinates defining the position of each atom in the two or three dimensional space, by using as a fitness function the matrix of the known or measured distances of the atoms;

c) subjecting the first and second set of coordinates of position of each atom to combination for atom according to predetermined combination rules, thus producing at least a new first and second set of coordinates of position for each atom;

d) calculating the fitness score of the said new first and second set of coordinates of position according to step b);

e) subjecting the said new first and second set of coordinates of position again to combination according to step c) and repeating the said steps c to e) until at least one new first or second set of coordinates of position reaches a maximum fitness score or is greater than a minimum predefined fitness score.

40. A method according to claim 39, characterized in that for each combination steps of at least one first and one second set of coordinates several new sets of coordinates are obtained by the combinations of the said at least first and second set of coordinates.

41. A method according to one or more of the preceding claims 36 to 40 characterized in that at least one hidden or hypothetic atom is added to the database of geographical sites of which neither the coordinates nor the distances are known and a first and

a second set of coordinates for the said at least one atom being freely defined.

42. A method according to claim 41, characterised in that the calculation of the evolutionary algorithm is carried out in parallel for the database provided with the at least one hidden or hypothetic atom and without the at least one hidden or hypothetic atom and the best fit set of coordinates of position of the totality of the atoms obtained by the two parallel calculations are compared.

43. A method according to one or more of the preceding claims 36 to 42, characterised in that a further different pre or post processing phase is provided.

44. A method according to claim 43, characterised in that in a preventive phase the known distance data matrix is subjected to treatment by means of a Self Organising Map algorithm, the clusters formed by this algorithm in the different units being then subjected to the method steps according to one or m ore of the preceding claims 36 to 43.

45. A method according to one or more of the preceding claims 41 to 44, characterised in that it is a method for finding out the presence and/or the position of at least an unknown or hidden atom in the structure of the molecule.

46. An apparatus having artificial intelligence, the said apparatus being provided with a processing unit (1), the said processing unit being connected to a data memory (3) and to a program memory (2);

The processing unit being further connected to one or more different sensors for detecting or measuring different physical and/or chemical conditions or

effects or processes characterising or occurring in the environment;

The processing unit further being connected to data input means by means of a service person or a data input line from other data collecting apparati;

The processing unit being also connected to means for carrying out mechanical, physical or chemical actions, such as actuators or the like;

in the program memory a program executable by the processing unit being loaded which program has a routine for driving the sensors and saving in a univoquely recognizable way each data collected by the sensors and or for saving data inputted by a service person or by other apparati, driver for activating or deactivating the means for carrying out mechanical, physical or chemical actions, such as actuators or the like;

the program stored in the program memory further comprising means for evaluating the data collected by the sensors and/or the data inputted by a service person or by other apparati;

characterised in that

the program having a subroutine for executing an algorithm according to one or more of the preceding claims 1 to 11 on the collected and/or inputted data.

47. An apparatus according to claim 46, characterised in that the program is provided with a subroutine for carrying out a cognitive analysis of multidimensional data by treating the said data with a method for projecting information data belonging to a multidimensional space into a space having less dimensions comprising the following steps:

Providing a database of N-dimensional data in the form of records having a certain number of variables.

Defining a metric function for calculating a distance between each record of the database.

Calculating a matrix of distances between each record of the database by means of the metric function defined at the previous step

Defining a n-1 dimensional space in which each record is defined by n-1 coordinates.

Calculating the n-1 coordinates of each record in the n-1 dimensional space by means of an evolutionary algorithm;

Defining as the best projection of the records onto the n-1 dimensional space the projection in which the distance matrix of the records in the n-1 dimensional space best fits or has minimum differences with the distance matrix of the records calculated in the n-dimensional space.

48. An Apparatus according to claim 47, characterised in that a database is provided in which the distances between the records are already contained.

49. An apparatus according to claims 47 or 48, characterised in that as an evolutionary algorithm a so called genetic algorithms is used.

50. An apparatus according to one or more of the preceding claims 47 to 49, characterised in that the subroutine provides for the following steps encoding each individual record or variable represented by a point having coordinate X and Y;

defining a set of different X and Y coordinates for each point forming a first population of

projections solution onto the less dimensional space, usually a two or three dimensional space.

Calculating the fitness score for each of the projections of this first population by using as the fitness function the matrix of distances of the single points in the originally N dimensional space;

Subjecting the population of projections to combination according to certain combination rules thus producing a first generation population of projections which comprises X and Y coordinates for the points which are a combination of the coordinates provided in two projections of the parent generation;

Calculating the fitness score of the projections of the first generation and forming again a new generation basing on the first generation.

51. An apparatus according to one or more of the preceding claims 47 to 50, characterised in that the genetic algorithm is the so called GenD algorithm.

52. An apparatus according to one or more of the preceding claims 47 to 51, characterised in that a hidden point can be defined, which corresponds to a hidden record or a to a hidden variable and whose existence is only guessed, the said hidden point is added in the parent population by giving to it position coordinates X_{hi} and Y_{hi} in the projection.

53. An apparatus according to one or more of the preceding claims 47 to 52, characterised in that the calculation of the evolutionary algorithm is carried out in parallel with the hidden point and without the hidden point and the best fit projections obtained by the two parallel calculations is compared.

54. An apparatus according to one or more of the preceding claims 47 to 53, characterised by the further

steps of providing a database comprising a certain number of records each one characterised by a certain number of variables,

elaborating the database alternatively or in parallel according to two ways:

a first way by which the records are considered as being points and the variables as being the coordinates of the points.

A second way by which the variables are considered as being points and the records are the coordinates.

55. An apparatus according to one or more of the preceding claims 47 to 54, characterised in that it comprises a further different treatment of the data as a pre or post processing phase.

56. An apparatus according to one or more of the preceding claims 55 characterised in that the data is processed in a preventive step by means of a Self Organising Map algorithm, the clusters formed by this algorithm in the different units being then subjected to treatment according to one or more of the proceeding claims 47 to 55.

57. An apparatus according to one or more of the preceding claims, characterised in that a relationship between the collected data records of the collected data is determined by means of the distance of each data record from the other data records and the said distance being used as a relevance weight of each data record in determining the activation or deactivation of one or more of the means for carrying out mechanical, physical and or chemical actions.

58. An apparatus according to claim 57, characterised in that a maximum distance for each data

record from the other is set for discriminating the data records to be used in determining the activation or deactivation of one or more of the means for carrying out mechanical, physical and or chemical actions.

59. An apparatus according to claims 56 or 57, characterised in that the clustering or distance of the data records on the map on which the database has been projected is used as a measure of similarity of the data records or of the variables related to the said data records.

60. A Method for providing an apparatus having artificial intelligence with a simulation of intuitive behaviour, the said apparatus comprising:

A processing unit (1), the said processing unit being connected to a data memory (3) and to a program memory (2);

The processing unit being further connected to one or more different sensors for detecting or measuring different physical and/or chemical conditions or effects or processes characterising or occurring in the environment;

The processing unit further being connected to data input means by means of a service person or a data input line from other data collecting apparati;

The processing unit being also connected to means for carrying out mechanical, physical or chemical actions, such as actuators or the like;

in the program memory a program executable by the processing unit being loaded which program has a routine for driving the sensors and saving in a univoquely recognizable way each data collected by the sensors and or for saving data inputted by a service

person or by other apparati, driver for activating or deactivating the means for carrying out mechanical, physical or chemical actions, such as actuators or the like;

the program stored in the program memory further comprising means for evaluating the data collected by the sensors and/or the data inputted by a service person or by other apparati;

The method being characterised by the following steps:

generating from the collected and/or inputted data a database with a certain number of records each one comprising a certain number of variables and which are relative to a N-dimensional space;

projecting the database considering the record as points and the variables as coordinates or the variables as points and the records as coordinates onto a space having a reduced number of dimension relatively to the space N dimensional space;

the projection being carried out by means of an Algorithm for projecting information data belonging to a multidimensional space into a space having less dimensions comprising the following steps:

Calculating a matrix of distances between each point defined by a record or a variable of the database by means of a metric function;

Defining a n-1 dimensional space in which each point represented by a record or a variable is defined by n-1 coordinates.

Calculating the n-1 coordinates of each point in the n-1 dimensional space by means of an evolutionary algorithm;

Defining as the best projection of the points onto the n-1 dimensional space the projection in which the distance matrix of the points in the n-1 dimensional space best fits or has minimum differences with the distance matrix of the points calculated in the n-dimensional space.

61. A method according to claim 60, characterised in that a database is provided in which the distances between the records are already contained.

62. A method according to claims 60 or 61, characterised in that as an evolutionary algorithm a so called genetic algorithm is used.

63. A method according to one or more of the preceding claims 60 to 62, characterised by an algorithm executing the following steps:

encoding each individual record or variable represented by a point having coordinate X and Y;

defining a set of different X and Y coordinates for each point forming a first population of projections solution onto the less dimensional space, usually a two or three dimensional space.

Calculating the fitness score for each of the projections of this first population by using as the fitness function the matrix of distances of the single points in the originally N dimensional space;

Subjecting the population of projections to combination according to certain combination rules thus producing a first generation population of projections which comprises X and Y coordinates for the points which are a combination of the coordinates provided in two projections of the parent generation;

Calculating the fitness score of the projections of the first generation and forming again a new generation basing on the first generation.

64. A method according to one or more of the preceding claims 60 to 63, characterised in that the evolutionary algorithm is the so called GenD algorithm.

65. A method according to one or more of the preceding claims 60 to 64, characterised in that a hidden point represented by a hidden record or a hidden variable can be defined, which corresponds to a hidden point on the map and whose existence is only guessed, the said hidden point being added in the parent population by giving to its position coordinates X_{hi} and Y_{hi} in the projection.

66. A method according to claim 65, characterised in that the calculation of the evolutionary algorithm is carried out in parallel with the hidden point and without the hidden point and the best fit projections obtained by the two parallel calculations is compared.

67. A method according to one or more of the preceding claims 60 to 66 characterised by the further steps of providing a database comprising a certain number of records each one characterised by a certain number of variables,

elaborating the database alternatively or in parallel according to two ways:

a first way by which the records are considerd as being points and the variables as being the coordinates of the points.

A second way by which the variables are considered as being points and the records are the coordinates.

68. A method according to one or more of the preceding claims 60 to 67, comprising a further different algorithm treating the database as a pre or post processing phase.

69 A method according to claim 68, characterised in that the database is processed in a preventive stage by means of a Self Organising Map algorithm, the clusters formed by this algorithm in the different units being subjected to a projection by means of the algorithm according to one or more of the proceeding claims.

70. A method according to one or more of the preceding claims 60 to 70, characterised in that the clustering or distance of the points on the map on which the database has been projected is used as a measure of similarity of the records or of the variables related to the said point.

71. A method according to one or more of the preceding claims, characterised in that a database comprising a certain number of records each one being related to a certain number of variables is provided, to the said database being further added the complementary variables to the variables originally provided and the said integrated database being subjected to projection onto a less dimensional space, particularly on a two or three dimensional space;

The distance in the map between each variable and its complementary variable being used as a measure for the relevance of said variable in the database.